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WHY BARKBEETLES FOLLOWED THE FIRE ON THE NORTHFORK BURN

by

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A five-year study of the insect infestations which developed after the fire on the Northfork Burn of 1924 on the Sierra National Forest, California, has recently been completed by the Bureau of Entomology and a final report submitted.

On this, as on a number of other burns in similar type which have been kept under observation, a heavy concentration of barkbeetles developed in surviving trees during the first two seasons following the fire. The study of the Northfork Burn has gone farther than any previous study into the reasons for this concentration and causes of the relationship between fire damage and barkbeetle infestations. The results indicate that the attraction of certain species of barkbeetles to burns is an indirect one, determined largely by the extent to which fire injury suppresses the growth rate of surviving trees.

The Northfork Burn was typical of severe fires which develop in the border type of yellow pine and brush areas on the western slopes of the Sierra Nevada Mountains. During the period June 22-27, 1924, this fire covered a total of 5480 acres, of which 370 acres was burned by severe crown fire, 1300 by partial crown fire, and 3790 by ground fire. Out of a total stand of 19,111,000 board feet, 8.2 per cent was killed outright by the fire. Before the close of the 1924 season another 3.5 per cent of the stand died, mainly as a result of barkbeetle attacks in fire-injured trees. During the season of 1925, although the surviving trees started new foliage growth in the spring, a total of 3,698,000 board feet, about 20 per cent of the remaining stand, was killed. In 1926 only 2.6 per cent of the stand was killed, the barkbeetle infestation returning to an endemic condition which continued during 1927 and 1928.

It was found that trees partially defoliated by scorching of the needles were consistently selected by the beetles. Trees with basal scars, due to burning one side of the trunk near the ground, were not attractive unless this injury was accompanied by scorching of the foliage and cambium in the upper trunk. In five recognized classes of injury in trees surviving the fire the per cent killed by insects was determined as follows:

Class of Injury	Per Cent Killed by Insects (Volume)
I. No fire injury	.9%
II. Less than 25% of crown defoliated	7.1%
III. 25 to 50% " "	51.6%
IV. 50 " 75% " "	76.9%
V. 75 " 100% " "	44.2%

Class V contained a high per cent of young vigorous trees scorched by ground fires. These trees were apparently not attractive to barkbeetles, and a higher survival resulted than in Class IV, which contained a higher percent of large trees.

The western pine beetle (Dendroctonus brevicomis Lec.) was the insect largely responsible for the killing of trees subsequent to the fire, and accounted for about 75 per cent of the total loss by volume. Conditions for the brood development of this beetle were found to be unfavorable in fire-injured trees, especially in those only partially defoliated. The actual increase in numbers of beetles, as determined by the ratio of parents to their successful progeny, was less than that which usually develops in normal trees. This condition apparently prevented the building up of an aggressive epidemic, and the infestation subsided as soon as the supply of trees rendered susceptible by fire injury was exhausted.

The cycle of western pine beetle infestation on adjoining areas was similar to that within the burn. However, the volume of increase in 1924 and 1925 on the burn was found to indicate that developments within the burn materially affected the course of the infestation on adjoining areas.

It was found that a high per cent of trees selected by the western pine beetle were those which had made little or no growth since the fire. All defoliated trees on the burn received a severe setback in growth as a result of fire injury combined with the drought conditions of 1924. Of the trees attacked by barkbeetles up to the close of the 1925 season, 96 per cent of them had made little or no perceptible growth since the fire. This condition was pointed out by Dr. F.C. Craighead, whose observations on trees in the sample plots were published in the Journal of Forestry in November, 1927. Many of the heavily defoliated trees formed no perceptible growth rings in 1925 and 1926, although they put out new foliage during these seasons; and those surviving to October, 1928, made only suppressed rings during the seasons of 1927 and 1928.

Observations made within the burn and from trees on another area which were scorched by experimental burning show that the western pine beetle is not attracted to fire-injured trees as a result of odors, heat or other influences produced directly by the fire. Heavily scorched trees did not attract the beetles until several months after the fire occurred, or not until suppression of the growth rate had set in as a result of defoliation by the fire. It is apparent, therefore, that the extent to which this barkbeetle concentrates in burns of the yellow pine type depends upon the character of the fire and the amount of defoliated or partially defoliated timber which survives the initial fire injury.

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